

LMRI (IST-ITN) Activity Report (2011-2012). Summary

The ITN, where the Metrology Laboratory of Ionizing Radiation (LMRI) was integrated, has been merged in the *Instituto Superior Técnico* (IST) of Technical University of Lisbon. This integration is regulated by the decree-law nr. 29/2012 of February 9. The IST is a school of Engineering, Science and Technology and Architecture. The IST maintains all attributions and duties regarding to LMRI- ITN.

During the period of this report the Metrology Laboratory of Ionizing Radiation (LMRI) has been involved in activities related with scientific, technical and legal metrology.

LMRI has participated in the iMERA European project JRP06 "Increasing cancer treatment efficacy using 3D brachytherapy" which has finished in July 2011. With the collaboration of the ITN group of radioactivity measurements and ITN experts in radioactive waste, LMRI participates in the project EMRP IND 04-MetroMetal "Ionising radiation metrology for the metallurgical industry", started at 01/12/2011 and will participate in the project JRP-i13 MetroNORM "Metrology for processing materials with high natural radioactivity", approved in 2012. The start date will be 01/06/2013.

LMRI participates in EURADOS Intercomparison on Monte Carlo modeling for the in-vivo monitoring of ^{241}Am in skull phantoms (in progress).

The collaboration with the University has continued. A PhD thesis in the field of air kerma primary standard for ^{60}Co gamma rays is ongoing with the collaboration of the Laboratoire National Henri Becquerel, CEA and the IPQ (Portuguese Institute for Quality). The design and construction of a new model of graphite cavity chamber has been realized. This new model has a volume of 6 cm³, approximately and spherical ends. An automated system was programmed with *Labview* and implemented in order to control the data acquisition equipment and to log the measured values for current/charge, temperature, humidity and pressure.

Five MSc theses and two BSc theses have been realized at LMRI and presented at the University and at the High School of Health Technology of Lisbon of Lisbon Polytechnic Institute, respectively.

Collaboration with BIPM was agreed in the framework of the construction of a free air chamber, the air kerma primary standard for low and medium X-ray energies (20 keV to 150 keV). Lack of financial resources has not allowed the expected development of the project.

A one-day, 16th November 2012, Workshop entitled "Ionizing Radiations Metrology and Clinical Applications" was co-organized with the Centro Hospitalar Lisboa Norte, Hospital de Santa Maria with two sessions: Radiotherapy and Radiodiagnostic. The goal of this workshop was to strength the link between the Metrology Laboratory and the stakeholders and final users. The Workshop had 40 participants and the support of the Medical Physics Division of Portuguese Physical Society.

In 2011, LMRI participated in a comparison of therapy level ionizing chamber calibration coefficients promoted by the AIEA. The results were known during 2012. For the comparison of the air kerma, the value was 0.998 and for the comparison of absorbed dose to water, the value was 0.995. These results are inside the range of values which does not need any

corrective action. LMRI also participated in the TLD audit to the absorbed dose to water for ^{60}Co promoted by the AIEA. The results obtained for the exercise of 2012 showed a relative deviation of -0.5%. Agreement within $\pm 3.5\%$ is considered satisfactory by the AIEA.

The dosimetry of radiation qualities used in diagnostic radiology, including conventional X ray examinations, mammography and computed tomography has been carried out enabling the LMRI to calibrate clinical dosimeters. LMRI participated in the EURAMET 1177 project, with the GAEC as pilot laboratory, on Air Kerma and KAP. We are waiting for the report.

A review of the 43 Calibration and Measurement Capabilities (CMC's) was realized according the recommendations of the EURAMET and this includes a complete revision of CMC's due to changes in traceability to the ITN air kerma primary standard for Cs-137 and Co-60, a complete revision on uncertainty calculation due to a revision in the procedure and the inclusion of inter-laboratorial comparisons support to CMC lines.

LMRI provides the community, mainly hospitals, industry, universities, armed forces and IST/ITN Units with calibration and metrological control services. In this period 23 medical dosimeters were calibrated on absorbed dose to water for Co-60 gamma rays and 317 dosimeters were calibrated and controlled. About 2250 TLD's were irradiated.

To monitor the Quality Management System two external audits in the framework of the EURAMET and IPAC (Portuguese Accreditation Body), have been carried out. The EURAMET audit, a peer review audit, has occurred at December 2012, in the framework of the project 1123 entitle "On site peer review". Three institutes, INRIM (Italy), CEM (Spain) and IPQ (Portugal) participated on this Project. According to the auditors, the LMRI metrology quality system and its implementation to demonstrate the conformity with the requirements of CIPM-MRA is adequate. LMRI participated in the audits to CIEMAT-LMRI and INRIM-ENEA.

Internal audits are conducted annually involving all requirements of ISO 17025:2005 and include all activities corresponding to the CMCs and QMS. The internal audits are performed by external auditors from other NMI's, and by technical experts from other institutions or from ITN.

Recently, March 2013, the Quality Management System of the LMRI has been positively re-evaluated in the framework of the TC- Quality of EURAMET.

The results obtained have been published in national and international journals, in conferences and lectures.

The LMRI has currently one researcher, the head of the LMRI, and two technicians.